UDC 551.506.1:551.513:551.524.35

THE WEATHER AND CIRCULATION OF OCTOBER 1968

Progression of Large-Amplitude Features at Midlatitudes With Rapidly Varying Temperatures

A. JAMES WAGNER

Extended Forecast Division, Weather Bureau, ESSA, Suitland, Md.

1. HEMISPHERIC MEAN CIRCULATION

The progression of the planetary waves as reflected in 30-day mean charts at 700 mb that had been occurring during September (Posey, 1968) continued in many areas through October. The mean trough in the Gulf of Alaska intensified further and moved to a position near 145°W (fig. 1). The ridge which had been near the west coast during September progressed to the favored location near the Continental Divide, while the mean trough remained with little change near the Mississippi Valley. The unusually strong closed Low south of Iceland deepened further during October while moving slightly southward and phasing with an eastward-moving trough at lower latitudes near longitude 35°W.

Blocking, which has been prevalent at high latitudes of the Western Hemisphere for several months, continued during October and became even stronger (figs. 2, 3). Heights at 700 mb were as much as 113 m above normal over the Davis Strait area, while the deep Low south of Iceland produced a 700-mb anomaly of 140 m below normal. Note the easterly components of 700-mb flow over the Arctic Ocean and North Atlantic near southern Greenland (fig. 4). The 30-day mean 700-mb polar westerlies computed between 0° and 175°W for the latitude belt 55° to 70°N have been below normal since June 1968.

Western Europe was under the influence of a warm ridge, and the confluence between mild Atlantic air from the Azores region and Arctic flow from northern Greenland (fig. 1) generated several vigorous storms in the Scandanavian area which swept rapidly eastward across northern Russia in the abnormally fast westerly flow (fig. 2). The lower latitude portions of some of the daily troughs had a tendency to shear off near the Aegean Sea, producing a weak monthly mean low center and heights 31 m below normal (figs. 1 and 2).

Above normal heights over central Siberia south of the main band of westerlies were related to an abnormally deep trough east of Kamchatka as cold Siberian air contributed to frequent cyclogenesis over the relatively mild ocean waters (figs. 2 and 3). The deepening of this

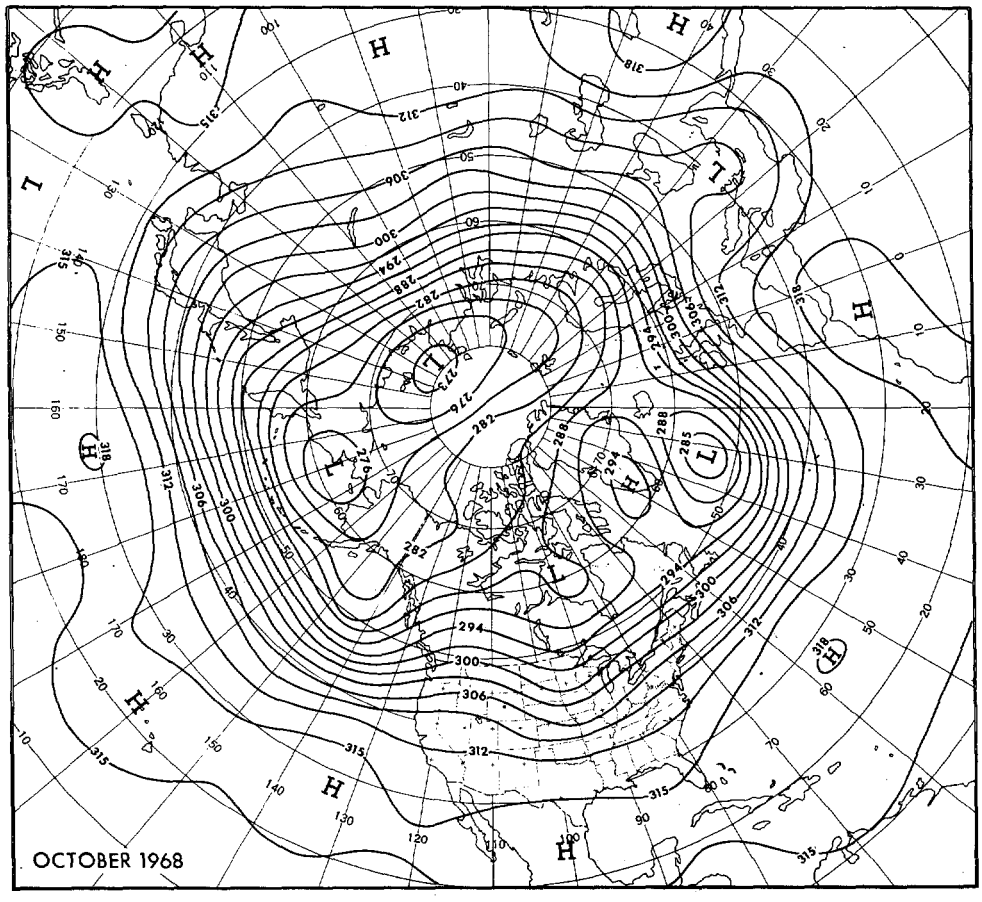


FIGURE 1.—Mean 700-mb contours (decameters) for October 1968.

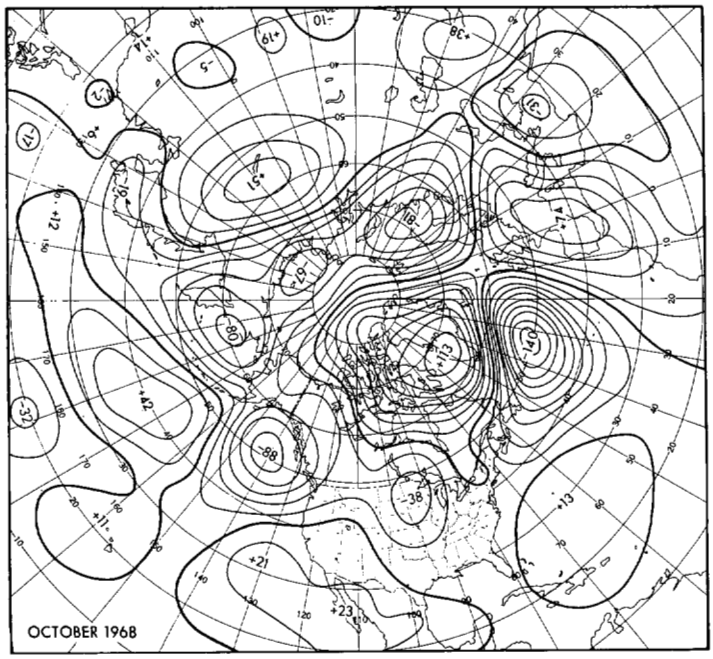


FIGURE 2.—Departure from normal of mean 700-mb height (meters) for October 1968.

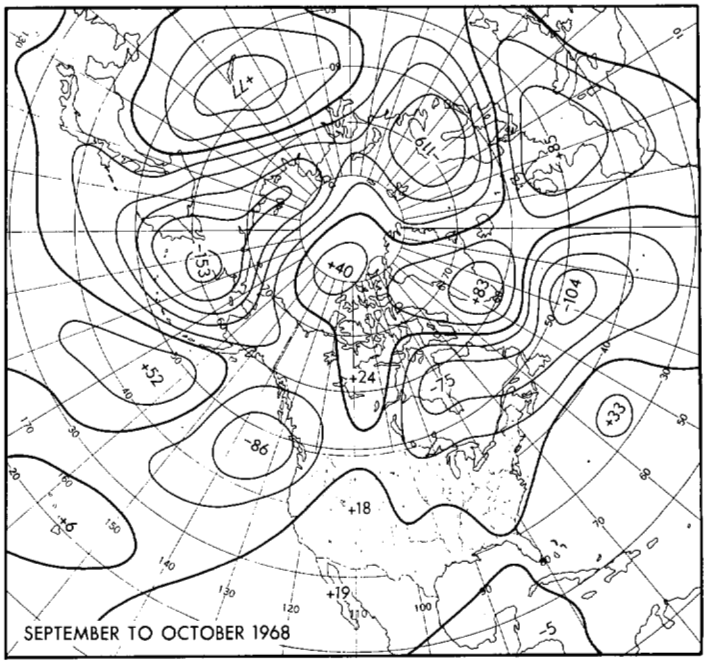


FIGURE 3.—Mean 700-mb height anomaly change (meters) from September to October 1968.

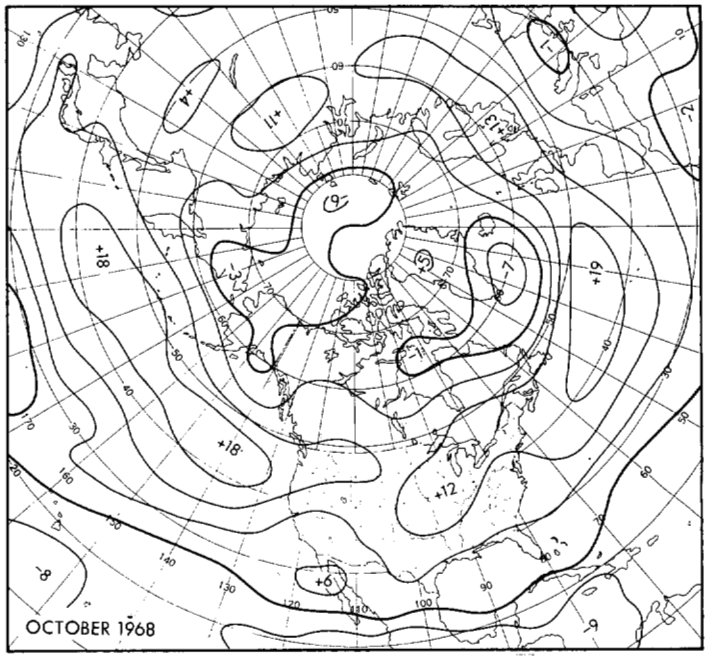


FIGURE 4.—Mean westerly component of 700-mb geostrophic wind (meters per second) for October 1968. Easterly components are shown as negative values.

trough, in turn, helped to force the Gulf of Alaska trough farther eastward.

An interesting new figure shown for the first time this month is the monthly mean brightness composite made from the daily photos taken by the ESSA–7 Satellite (fig. 5). (The automated program for constructing this photograph was developed by Mr. Arthur Booth, of the National Environmental Satellite Center, ESSA.) Brightest areas are the persistently snow-covered sections of Greenland, northern Canada; and northern Siberia. Snow, and possibly some cloud, outline the Himalayas, and a combination of snow and persistent orographic cloud stands out in the Canadian Rockies. The sandy areas of the Sahara and Arabian Deserts are quite bright, although virtually cloudless.

Of greatest meteorological interest are the moderately bright areas outlining the Intertropical Convergence Zone, midlatitude jet streams, and centers of action. Note especially how the extensive bright band across the northern Pacific between 40°N and 45°N lies in and near the area of strongest westerlies (figs. 1 and 4). A well-defined extensive cloud band at midlatitudes did not exist in the Atlantic, but bright areas south of Greenland and Iceland in the region of the mean 700-mb low center and strongest easterly anomalous flow (figs. 1 and 2) indicate the area where cyclones most frequently stalled. The rather strong bright band extending eastward from the Baltic across Russia between 50°N and 60°N probably represents both clouds and snow cover from the frequent storms moving eastward through that region.

2. MONTHLY TEMPERATURE AND PRECIPITATION

The departure from normal of the October 1968 mean temperature (fig. 6) shows a rather irregular pattern with few anomalies exceeding about 3°F reflecting the variable nature of the month. Vigorous storm systems with accompanying cool air swept into the Pacific Northwest several times during the month. The deeper than normal trough in the Mississippi Valley (figs. 1 and 2) deployed cool air southward and then eastward to the Appalachians. A tendency toward downslope components east of the Rockies may have contributed to warmth in the Western Plains, and mild air circulating around the Davis Strait block and, at times, the Bermuda High, produced the warmer than normal temperatures in the Great Lakes area and along the east coast, where most water temperatures were also above normal.

No stations reported record monthly mean tempera-

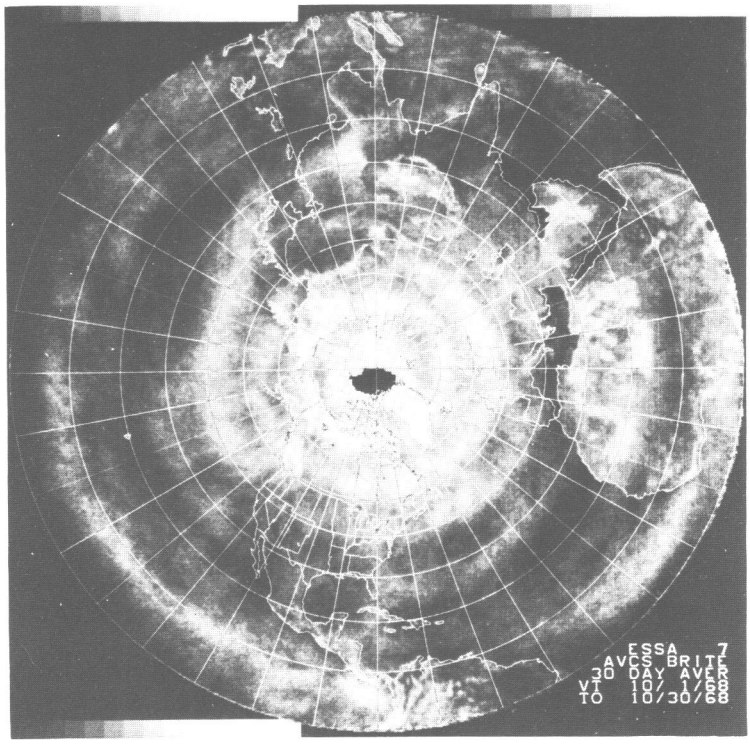


FIGURE 5.—Mean brightness composite photograph from daily observations made from the ESSA-7 satellite, for October 1968.

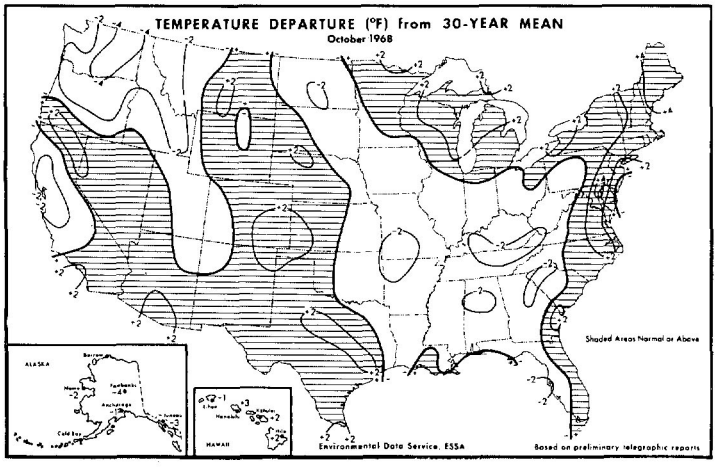


FIGURE 6.—Departure from normal of average surface temperature (°F) for October 1968 (from EDS, 1968).

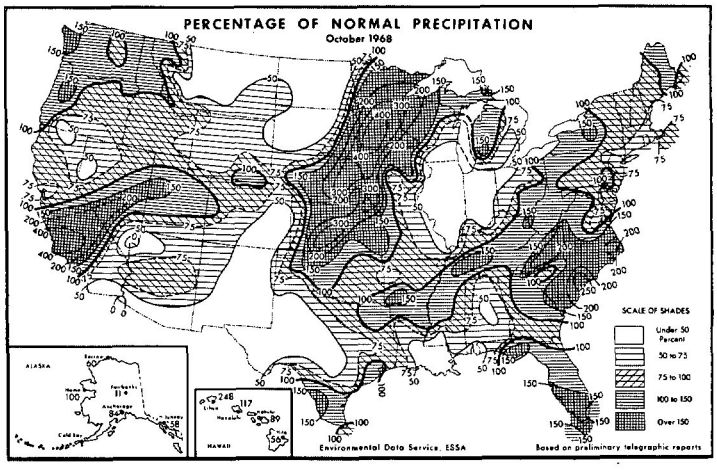


FIGURE 7.—Percentage of normal precipitation for October 1968 (from EDS, 1968).

tures, and only about half a dozen had mean temperature anomalies in the *much above* or *much below* categories during October 1968. However, Birmingham, Ala., and Olympia, Wash., reported their 10th consecutive month with below normal temperatures, and 1968 has been the fifth coldest year of record through October at Jackson, Miss.

Most of the Nation had normal or above precipitation, with greatest excess on a percentage basis in the Central Plains and northern Mississippi Valley (fig. 7). Most of this fell in connection with a storm about midmonth, and is related to the negative anomaly center over Minnesota (fig. 2). Several stations in this area set records or near records for October precipitation (table 1).

The relatively heavy precipitation in southern California was related to strong trough components which traversed the area during the second and fifth weeks (see section 3) and is not well related to the monthly mean pattern, although there was a slightly greater than normal westerly component at 700 mb (fig. 2). Heavier than normal precipitation on the Pacific Northwest coast is due to the stronger than normal westerly flow impinging upon the coastal ranges.

Above normal precipitation in portions of the Southeast was due mainly to hurricane Gladys, which crossed the northern portion of the Florida peninsula during the third week of the month. The areas of heaviest rainfall appeared to be better related to the frictional and topographical effects of coastlines and mountains than to the specific path of the storm center.

Drier than normal areas were confined to the Northern and Southern Plains, part of the Midwest, and the central Gulf Coast. Two stations reported near-record dryness in October (table 1).

TABLE 1.—*Stations reporting unusually wet or dry weather during October 1968*

Station	Total Precipitation (in.)	Remarks
Dodge City, Kans.	4.88	Wettest October of record
Sioux City, Iowa	4.77	Wettest October of record
Sioux Falls, S. Dak.	4.57	Wettest October since 1911 and 2d wettest of record
Omaha, Nebr.	4.62	2d wettest October in 50 yr
St. Cloud, Minn.	5.80	Wettest October since 1899 and 2d wettest of record
Minneapolis-St. Paul, Minn.	5.62	3d wettest October of record
Duluth, Minn.	5.28	3d wettest October of record
Baton Rouge, La.	.06	2d driest October of record
Bismarck, N. Dak.	.05	3d driest October of record

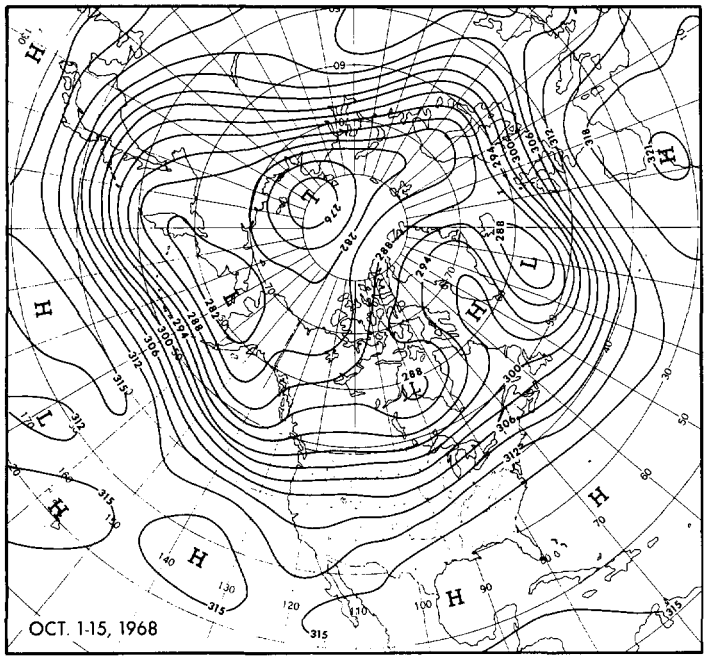


FIGURE 8.—Mean 700-mb contours (decameters) for Oct. 1–15, 1968.

3. VARIABILITY WITHIN THE MONTH INCLUDING WEEKLY WEATHER AND CIRCULATION

During the first half of the month an abnormally strong ridge (maximum height near 140 m above normal) formed in the central Pacific south of the Aleutians, in response to the initial deepening of the Kamchatka trough (fig. 8). The downstream flow pattern was of generally low amplitude, but with the main band of westerlies south of its normal position.

Rapid progression of systems at high latitudes over the Eurasian sector during the month forced the main center of cyclonic activity out from the coast into the Bering Sea with the principal broad trough extending southward over the central Pacific (fig. 9). The lower latitude portion of the Asiatic coastal trough was sheared off and left over Japan.

A small low center and maximum curvature remained in the Gulf of Alaska and eastern Pacific area, while the planetary waves from the Rockies to Europe amplified. The trough component dipping down into the eastern Gulf of Mexico is related to hurricane Gladys.

The change in height anomaly from the first half to the second half of the month is shown in figure 10, where the outstanding features are height falls of greater than 200 m

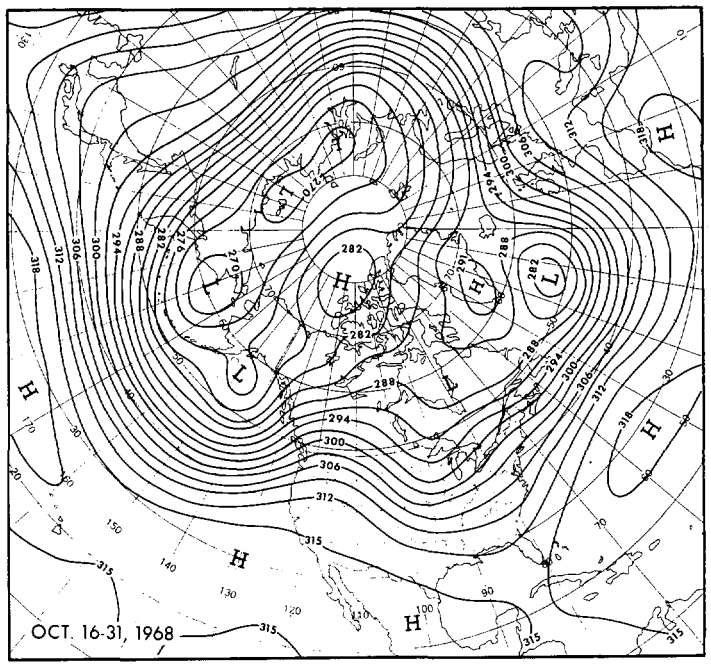


FIGURE 9.—Mean 700-mb contours (decameters) for Oct. 16–31, 1968.

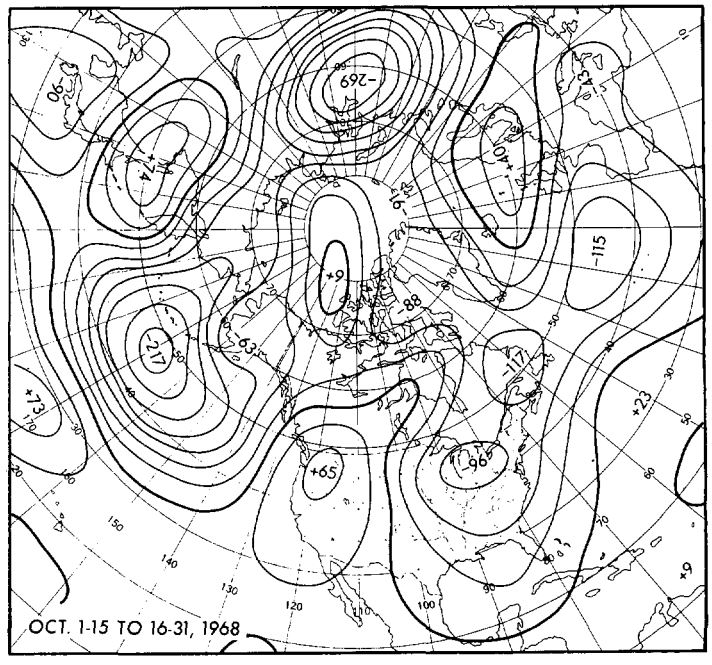


FIGURE 10.—Change in half-monthly mean 700-mb height (meters) between Oct. 1–15 and Oct. 16–31, 1968.

in north-central Russia and south of the Aleutians, where ridges were replaced by troughs. These and two other fall centers of around 100 m over the Great Lakes area and the eastern Atlantic combined to make a near-perfect wave number 4 anomaly height change pattern for the first to the second half of October 1968. The strengthening of the ridge in western North America and the beginning of a shift in blocking action to the North Sea area are shown by rises centered in these areas.

SEPTEMBER 30–OCTOBER 6

As the month opened most of the Country was cool and high pressure dominated the surface maps. The broad northwesterly flow from western Canada brought a mixture of Pacific and Canadian airmasses across the Nation

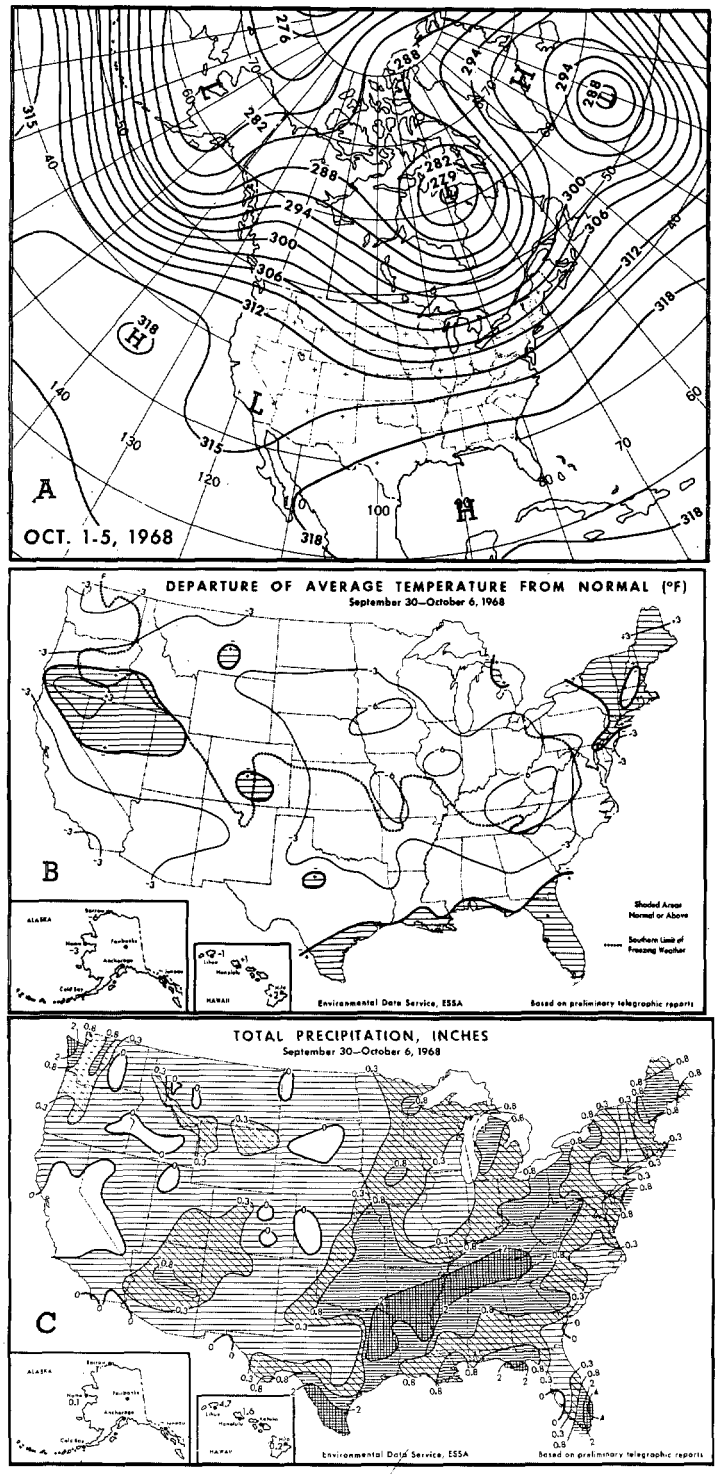


FIGURE 11.—(A) Mean 700-mb contours (decameters) for Oct 1–5, 1968; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (inches) for week of Sept. 30-Oct. 6, 1968 (from EDS, 1968).

to the Southeast (fig. 11A). Several sections had weekly temperatures more than 6°F below normal (fig. 11B). A few localities reported record early-season minima (table 2).

Confluence between this cool airstream and a lower latitude flow originating from a weak trough over southern California produced the first extratropical Gulf Coast disturbance of the season. The storm spread precipitation amounts in excess of 2 in. across much of the South, and lesser amounts northward through the East when it phased with a higher latitude trough at the end of the week (fig. 11C).

TABLE 2.—*Record early-season low temperatures established during October 1968*

Station	Date	Temperature (°F)
Sioux Falls, S. Dak	4	*22
Evansville, Ind	5	31
Montgomery, Ala	5	*39
Lynchburg, Va	5	29
Wilmington, N.C	5	41
Nashville, Tenn	5, 26	32, 27
Albuquerque, N. Mex	18	28
New Orleans, La	30	35
West Palm Beach, Fla	30	46

*Tied record.

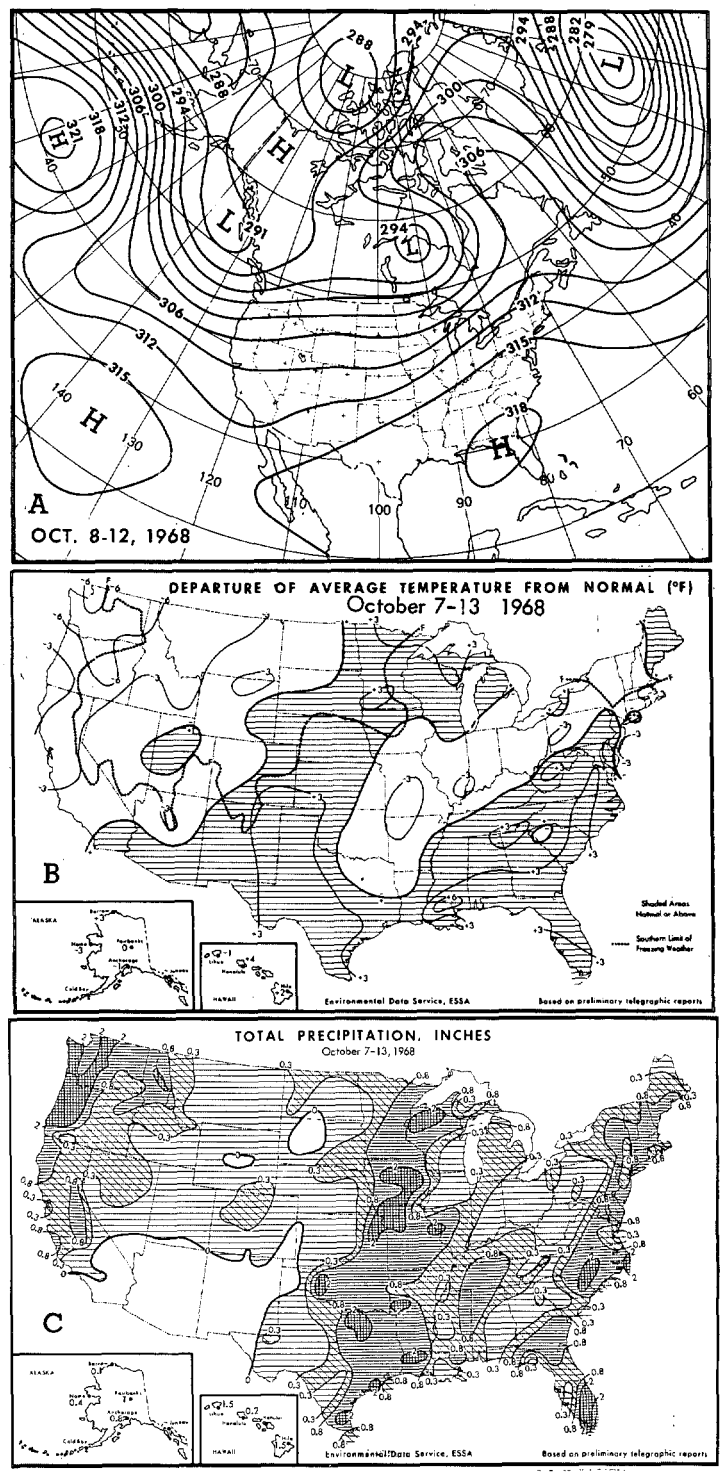
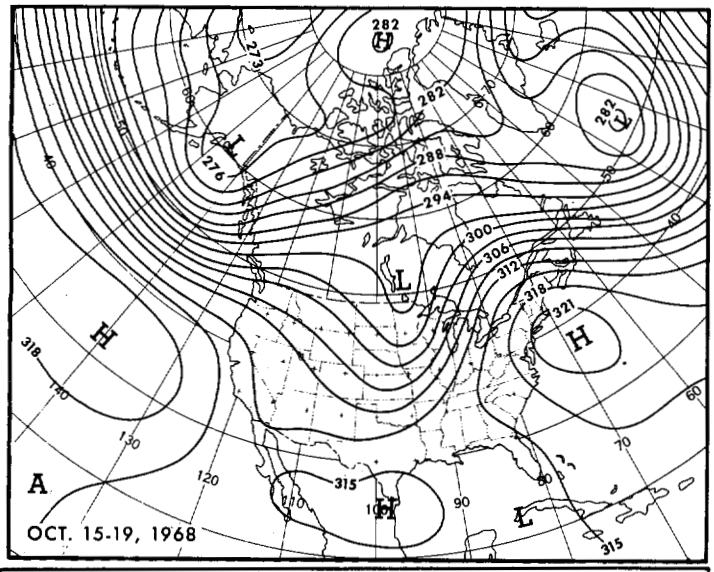
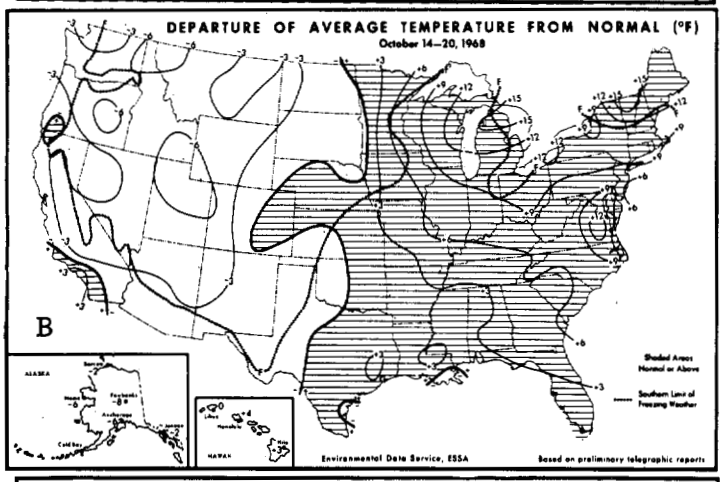


FIGURE 12.—Same as figure 11, (A) for Oct. 8–12, 1968; (B) and (C) for week of Oct. 7–13, 1968 (from EDS, 1968).





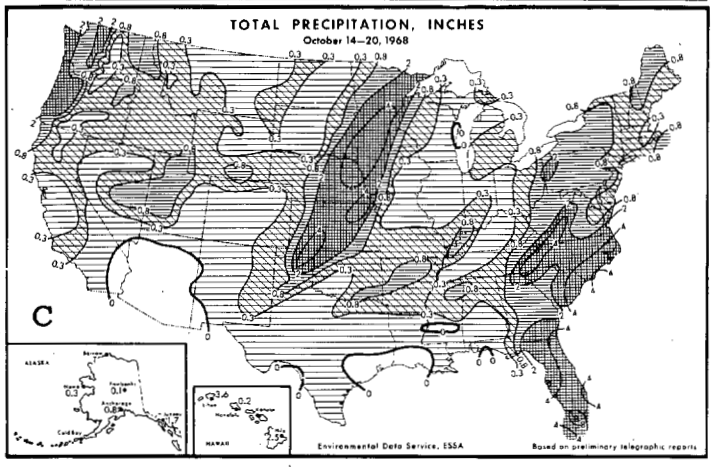


FIGURE 13.—Same as figure 11, (A) for Oct. 15–19, 1968; (B) and (C) for week of Oct. 14–20, 1968 (from EDS, 1968).

OCTOBER 7–13

During the second week of the month, the High south of the Aleutians reached its peak intensity, forcing the Gulf of Alaska trough eastward to a position just off the Pacific coast (fig. 12A). The blocking ridge over northeastern Canada reached its greatest strength and strong deepening occurred south of Iceland.

As a result of the generally weak southerly anomalous components of flow across most of the Nation (not shown) temperatures moderated in most areas east of the Divide and widespread but generally moderate amounts of precipitation occurred due to the absence of any intense storm systems (fig. 12B, C). Precipitation in excess of 1 in. and temperatures more than 6°F below normal occurred throughout much of the Pacific Northwest in response to the below normal heights, cyclonic activity, and air trajectories originating in the Aleutian area.

TABLE 3.—*Record late-season high temperatures established during October 1968*

Station	Date	Temperature (°F)
Pueblo, Colo.	14	90
Albuquerque, N. Mex.	14	85
Dodge City, Kans.	14	96
Amarillo, Tex.	13, 14	93, 94
Sault Ste. Marie, Mich.	15, 16	80, 80
Caribou, Maine	17	*79
Medford, Oreg.	26	85
Ely, Nev.	28	77
Boise, Idaho	29	*77
Lander, Wyo.	28	76
Sheridan, Wyo.	29	83
Casper, Wyo.	29	75
Billings, Mont.	29	80
Havre, Mont.	29	77
Wichita Falls, Tex.	30	91
St. Louis, Mo.	31	88

*Tied record.

OCTOBER 14–20

Most of the weather drama occurred during the third week of October. The trough which had been off the west coast the previous week moved inland to the Plains when the Aleutian ridge collapsed and was replaced by fast westerly flow (fig. 13A). Cool air covered most of the western half of the Nation, but it was not extremely cold due to its Pacific origin.

Rather rapid temperature changes occurred over New Mexico following the passage of the Pacific cold front. Albuquerque, N. Mex., reported its highest maximum temperature so late in the season on the 14th and its lowest minimum so early in the season on the 18th (tables 2 and 3). Roswell, N. Mex., experienced a rapid warming on the 19th, such that the daily minimum of 26°F and the maximum of 87°F *both* set records for the lowest and highest temperatures ever observed on that date.

The blocking ridge over eastern Canada settled southward and combined with an extremely strong Bermuda High displaced toward the mid-Atlantic coast (fig. 13A). At the same time, hurricane Gladys formed in the western Caribbean and moved slowly northward to near the west coast of Florida before crossing the northern part of the State and paralleling the South Atlantic coast at the end of the week.

The flow of tropical air between the Bermuda High and the Plains trough produced several record late-season warm readings (table 3) and weekly temperatures in excess of 15°F above normal in some parts of the Lakes and New England (fig. 13B). Daily temperatures (and humidities) reached levels which would be more normal in August.

A slowly northward-moving storm connected with the Plains trough produced record heavy rains of more than 4 in. in some areas of the Central Plains and northern Mississippi Valley (fig. 13C and table 1). Hurricane Gladys

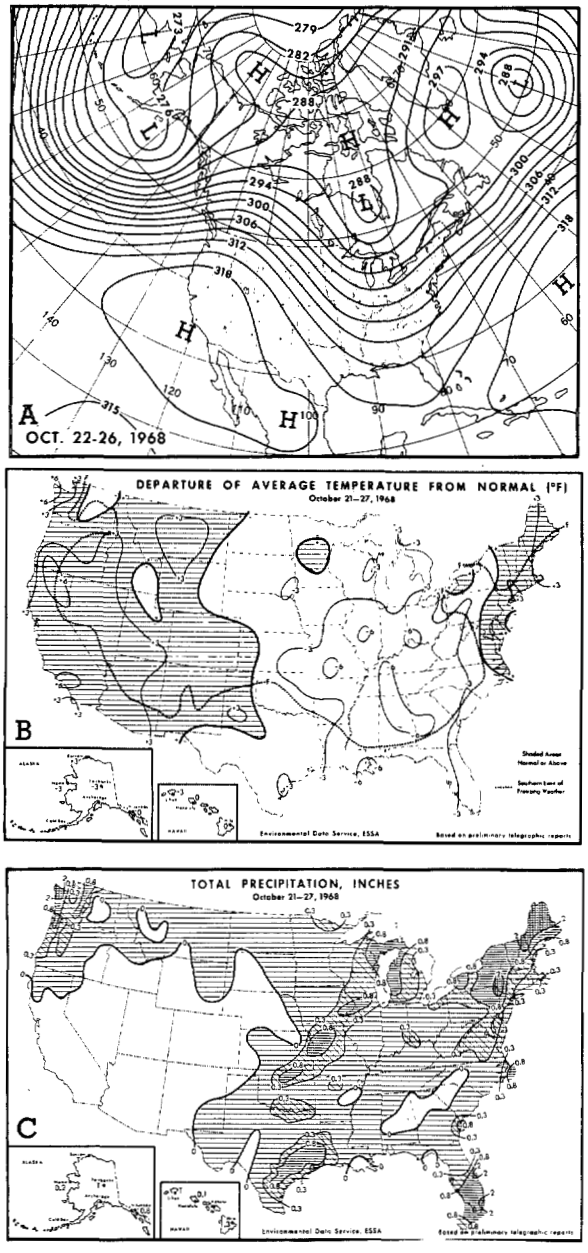


FIGURE 14.—Same as figure 11, (A) for Oct. 22–26, 1968; (B) and (C) for week of Oct. 21–27, 1968 (from EDS, 1968).

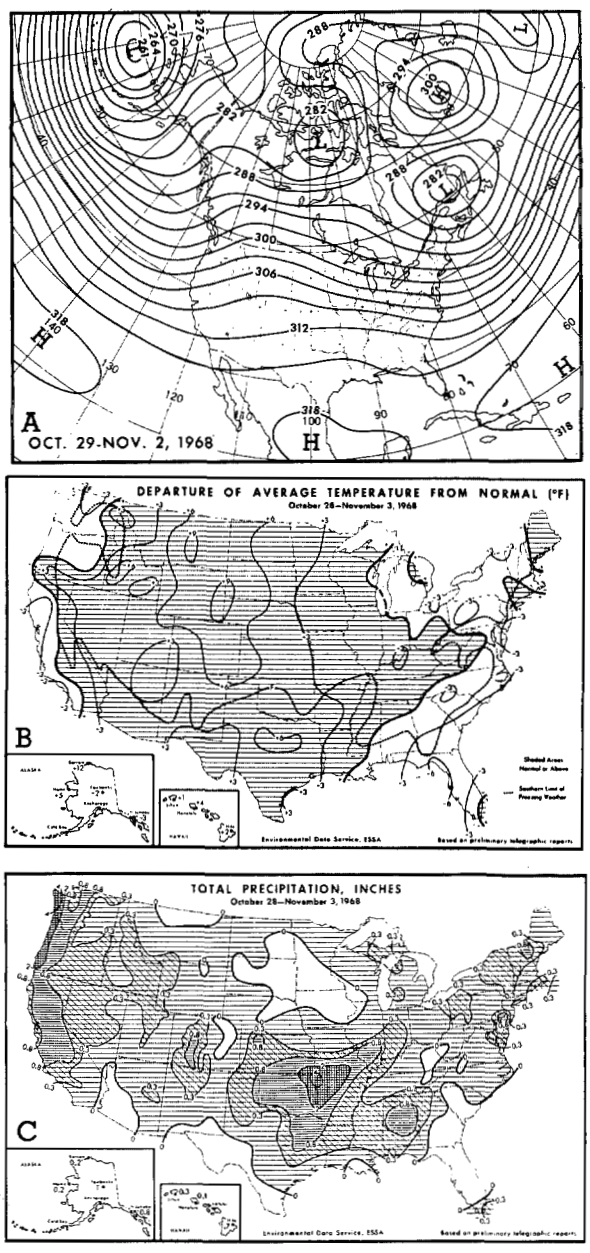


FIGURE 15.—Same as figure 11, (A) for Oct. 29–Nov. 2, 1968; (B) and (C) for week of Oct. 28–Nov. 3, 1968 (from EDS, 1968).

and the accompanying large-scale flow of tropical Atlantic air combined to give rainfall totals of generally 2 to 5 in. over much of the Southeast. Roanoke, Va., reported nearly 7 in. of rain from the storm system. Other sections of the Country had light or moderate amounts of precipitation.

OCTOBER 21–27

As the trough in the central Pacific amplified, a warm ridge developed over the Plateau and Northern Rockies and the Plains trough moved eastward to the Great Lakes-Appalachian area (fig. 14A). The West warmed rapidly to as much as 6°F above normal, while much lower temperatures, down to 7°F below normal, moved into the Midwest and Southeast (fig. 14B). This was the driest week of the month, with only the northwest, northeast, and southeast corners of the Country receiving heavy precipitation (fig. 14C).

OCTOBER 28–NOVEMBER 3

During the closing days of the month, a trough again progressed to near the west coast, resulting in flattening of the Rockies ridge and rapid eastward movement of its associated warm air (fig. 15A). This eastward progression of the warm air can be easily seen from noting the movement of the area of record late season maximum temperatures from Medford, Oreg., on the 26th to St. Louis, Mo., on the 31st (table 3). Most of the Nation had above normal temperatures for the week (fig. 15B). Moderate amounts of rainfall occurred over most of the Country, except along the Pacific Northwest coast near the strong trough and in the South-central States (fig. 15C).

REFERENCES

Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, Vol. 55, Nos. 41–45, Oct. 7, 14, 21, 28 and Nov. 4, **1968**, pp. 1–8.

Posey, J. W., "The Weather and Circulation of September 1968—Cool Over Much of the Nation With Progression of the Long Waves," *Monthly Weather Review*, Vol. 96, No. 12, Dec. **1968**, pp. 893–898.

U.S. GOVERNMENT PRINTING OFFICE : 1969—O-327-215